

**PUBLIC SERVICE COMMISSION, WEST BENGAL**  
**JUNIOR ENGINEERS (CIVIL/ MECHANICAL/ ELECTRICAL) RECRUITMENT EXAMINATION, 2022**

**ADVERTISEMENT NO. 09/2022**

**SCHEME AND SYLLABUS**

**S C H E M E**

The examination will comprise of two successive parts as follows :-

a) **Written Examination - Full Marks - 200, Time - 2 hours** : The written examination will consist of one paper covering Engineering subjects (Multiple Choice Objective Type Questions) for each of the three branches. There will be 100 questions carrying 2 marks each. The standard and syllabus of the written examination are mentioned in the appendix (Appendix 'A', 'B' & 'C').

b) **Interview - Full Marks - 100** : A limited number of candidates, selected on the results of the written examination, will be called to Interview carrying 100 marks. Final merit list will be prepared on the basis of the total marks obtained in the Written Examination and the Interview taken together.

**S Y L L A B U S**

**APPENDIX – “A”**

**SYLLABUS FOR WRITTEN TEST FOR RECRUITMENT TO THE POST OF  
JUNIOR ENGINEERS (CIVIL) IN WEST BENGAL SUBORDINATE SERVICE OF ENGINEERS**

**1. STRENGTH OF MATERIALS**

Centre of gravity of plane figures, composite rectilinear figures, simple structural sections, M.I. of lamina, composite areas & of simple structural sections, simple stresses & strains, Characteristics of stress-strain curve for Mild Steel, S.F. and B.M. diagrams of loaded beams (fixed beam excluded), Bending & Shear stresses of beams, slope and deflection of cantilever and simply supported beams (point load & UDL), direct & bending stress, Eccentric loading on masonry pillars.

**2. THEORY OF STRUCTURES**

Different types of frames-perfect, redundant & deficient, difference between statically determinate and statically indeterminate frames, Analysis of perfect frames, different methods (names only), Gravity structures – Dams & Retaining Walls (Rectangular & Trapezoidal sections), conditions of stability, Different types of failure of a Dam, Critical load on Columns – Euler's, Rankine's & B.I.S. Code formula.

**CONCRETE STRUCTURES**

Working stress method of design of simply supported R.C.C. rectangular beams (singly & doubly reinforced) and slabs (one way & two way), Cantilever slabs, singly reinforced T-Beams - Design of Reinforcements, Design of axially loaded R.C.C. short columns (square, rectangular & circular) by I.S. Code Formula, Isolated R.C.C. square footing of column, Basic Concept of pre-stressed concrete – Materials used.

**STEEL STRUCTURES**

Design of rivetted joints, Failure of rivetted joints, Eccentric rivetted connections (brackets), Design of rolled steel beams in flexure & shear for a given load, design of axially loaded columns using standard rolled I-sections with or without plates, Design of simple truss.

**TIMBER STRUCTURES**

Design of simple structures.

**3. CONSTRUCTION MATERIALS & PRACTICE**

**BUILDING MATERIALS**

Bricks – Traditional & Modular, Size & Weight, I.S. Classifications, Testing of Bricks, Mortar & Concrete – different types, Usual proportions, Specific uses, Slump of concrete, Recommended values of slump for various works, Water-Cement ratio – its effect on strength of concrete, Curing of concrete, Sources and uses of stone, Sand & lime, Mosaic Tiles & Roof Tiles, Period of curing timbers, Commonly used timber in engineering works & their specific uses, Uses of plywood, Laminated Board, Block Board, Particle Board, Expanded metal, Polymer, Plain & Frosted glass, Paints & Varnishes.

**CONSTRUCTION**

Foundation, Object, Shallow & Deep Foundation, Names of different types, their uses in specific locations, Brick Masonry works, General principles & precautions, reinforced brick work, its advantages, damp proofing – materials used, causes & effect of dampness, roofs and roof coverings – different types – uses at specific locations, flooring, doors & windows – different types – uses at specific locations, Stairs, different types (names only), their uses at specific locations, requirements of a good stair as per N.B.C., Scaffolding, Shoring, Underpinning, Formwork – materials used, characteristics of good formwork, rules for removal of formwork, Common construction equipments.

#### **4. FIELD SURVEYING**

Metric surveying chain, types – different types, uses, Triangulation and Traversing, Tie line, Check line & Base line offsets – different types, Field book entry, Right angle setting in field with instruments and with chain or tape.

Compass – different types, uses, bearing, W.C.B. & R.B., Fore & Back bearing, Local attraction, Declination, Dip, closing error of a compass traverse, causes, adjustment, permissible error in compass surveying.

Plane Table survey – suitability, advantages & disadvantages, methods of plane tabling, equipments necessary.

Levelling, types of level & leveling staff (names only), temporary adjustment of level, reduction of level, level book entry, reciprocal and profile levelling, correction for curvature & refraction, contouring, definition of contour, contour interval & horizontal equivalent, characteristics of contour lines, uses of contour map, methods of contouring (names only).

Theodolite Survey – different types of theodolite, important terms in connection with theodolite, uses of a theodolite, theodolite traversing, latitude & departure, closing error in a theodolite traverse, adjustments, permissible limits of error.

Curve setting – degree & radius of a curve, their inter-relation, elements of a simple curve, classification of curves.

#### **5. ESTIMATING, COSTING & CONTRACTS**

Specification of works and materials, Estimates, different Types, general items of works, Units of measurement for building works as per B.I.S. Code, method of measurement for different items of work and materials, present market rates of materials & unit rate of items of work, floor area, carpet area and plinth area, F.A.R., Rate analysis – factors governing it, schedule of rates, analysis of rates for different items of works of a building.

Contracts – different types, Contract documents, submission & opening of Tender, earnest money, security deposit, measurement book, work order book, imprest and temporary advance, material at site account, suspense account.

Valuation, functions of a Valuer, factors affecting the value of a property, value & cost, scrap value, salvage value, assessed value, speculative value, sinking fund, depreciation.

#### **6. PUBLIC HEALTH ENGINEERING**

##### **WATER SUPPLY**

Sources of water, ground water (springs, infiltration galleries & wells), Acquirer, Tube-wells – methods of boring, development of Tube-well, determination of tube diameter, length and diameter of a strainer, Motor & Hand Pump. Water requirements per capita demand, domestic, industrial & fire demands, population forecast. Intake works & transportation of water, Purification of Water, Removal of Salinity, Arsenic & iron. Raw water and Treated Water Quality. Treatment of water – plain sedimentation, feeding and mixing of coagulants, flocculation devices & clariflocculators, filters – rapid & slow sand filters, removal of hardness, disinfections – methods & applications. Different Pipe materials, Distribution of Waters, different systems & their applications, different appurtenances of distribution systems, guiding regulations of service connections according to Bengal Municipal Act.

##### **SANITARY ENGINEERING**

Elementary knowledge of Water & Air Pollution and Control. Classification of waste, necessity of waste disposal, different systems of Transportation of sewage, Sewers – Types, Sewerage, Sewer appurtenances, laying of sewers, quantity of sewage – domestic, industrial, storm water & ground water infiltration, estimation of run off, time of concentration, characteristics of sewage – Physical & Chemical (e.g. pH, colour, odour, turbidity, BOD, COD, nitrogen, chloride), sewage treatment processes - aerobic & anaerobic treatment, sewage treatment units, activated sludge process, trickling filter, septic tank, Rural Sanitation, Solid Waste disposal methods.

#### **7. IRRIGATION**

##### **PRINCIPLES OF IRRIGATION**

Necessity & benefits of irrigation – its ill effects, types of irrigation systems, methods of irrigation – surface irrigation, sprinkler irrigation and sub-surface irrigation.

##### **HYDROLOGY**

Measurement of rainfall – Symon's rain gauge, average rainfall over an area by arithmetical mean method, Thiessen polygon method and Isohyetal method, Run off - factors affecting it.

##### **WATER REQUIREMENT OF CROPS**

Duty, Delta and base period – their inter-relations, factors affecting duty, methods of improving duty, commanded area, capacity factor, time factor, outlet factor, crop ratio, overlap allowance.

##### **CANALS**

Classification of canals, canal linings – Types and advantages, different parts of irrigation canals – their functions, designs of canal sections for a given discharge (using Kennedy & Kutter's formula), Design of canal sections by using Manning Formula, Canal structures.

##### **WELL IRRIGATION**

Shallow and deep wells, yield from a well, advantages & disadvantages of well irrigation.

##### **TUBEWELL IRRIGATION**

Piped Water Irrigation, Design of Pipelines and losses.

##### **CROSS DRAINAGE WORKS**

Aqueduct, super passage, siphon aqueduct, level crossing.

#### **HEAD WORKS**

Object, layout and functions of head works, classification of dams, different types of earthen dams, causes of failure of earthen dams and safety measures, difference between weir, barrage and dams.

#### **FLOOD CONTROL**

Methods of flood control, reservoirs, flood walls, channel improvements, floodways. Cause & effect of flood.

#### **RIVER TRAINING WORKS**

Objectives, different types, guide bank, spurs, groynes, pitching, revetment, rip-rap.

### **8. ROADS & HIGHWAYS**

#### **INTRODUCTION**

Classification of rural (non-urban) & urban roads as per I.R.C., terrain classification as per I.R.C.

#### **ROAD GEOMETRICS**

Road alignment, vertical and horizontal curves. Cross-sectional elements, recommended land width for different classes of roads, recommended speeds, Camber-objective-recommended values of camber for different types of roads, Gradients for roads in different terrains, Grade compensation at curves on hill roads, super-elevation-objects, transition curves objects, sight distance, different types, perception time, brake-reaction time, lag time, lag distance. Equipments used in road construction.

#### **EARTH WORK**

Cutting, filling angle of repose, allowance for settlement, profile, benching, lead & lift, borrow pit & spoil bank.

#### **CITY ROADS**

Kerb & channel, pedestrian crossing, guide island, refuge island, traffic lane.

#### **HILL ROADS**

Retaining walls, breast walls, weep holes, catchwater drains, hair pin bend, cliff gallery.

#### **ROAD AGGREGATES**

Different types, requirements of good road aggregates, testing of road aggregates (names of tests & their objectives).

#### **HIGHWAY CONSTRUCTION**

Road structure, component parts, functions, soil stabilization methods, Road Drainage.

Water bound macadam roads – materials required – advantages & disadvantages.

Bitumen – sources – types, Asphalt, Tar.

Bituminous Road Types – Surface dressing (single & double coat), Grouting (semi grout & full grout), premix type (premix chipping carpet, premix macadam & premix concrete) – Functions, constructions, quantities of materials required for each type.

Cement concrete Roads : Pavement joints, necessity types, joint sealer, joint filler, dowel bar, tie bar, mud pumping,

Culverts & Bridges – differences – component parts – wing wall, Abutment and Piers.

Classification of Bridges, Span, Flood discharge, Waterway, Scouring, Depth of Foundation, Clearance and Free Board, Maintenance of Bridges.

### **9. SOIL MECHANICS & FOUNDATION ENGINEERING**

Classification of soil – Particle size – MIT & IS Sieve Analysis.

Index, properties of soil.

Phase diagram for dry, moist and saturated soil, Definition – void ratio, porosity, water content, degree of saturation, Unit weight, Sp. Gr., Density, bulk density, dry density, submerged density, air content etc.

Consistency of soil – Moisture content & volume relationship, Definition – Atterberg Limit, plasticity index, density index shrinkage ratio.

Permeability of soil – Darcy's law, coeff of permeability, factors affecting permeability.

Compaction – Dry density by Proctor's compaction.

Consolidation – Difference between compaction & consolidation, compression index, coeff of compressibility, volume compressibility, coeff of consolidation, settlement of foundation.

Shear strength – Definition of shear strength and shear parameters.

Earth Pressure – Active and passive earth pressure, coeff of passive earth pressure – Rankine's earth pressure theory, Angle of repose, pressure intensity diagram, Resultant thrust.

Foundations – Shallow & deep foundations, types of shallow foundation (names & uses only) types of deep foundation (names & uses only), Bearing capacity, Terzaghis bearing capacity formula, assumptions & problems, plate load test. Pile foundation – formula related to pile foundation, Dynamic Engineering News formula, Hiley's formula, static formula.

Soil Stabilization – Principles, types – Mechanical stabilization, cement stabilization, lime stabilization, bitumen, stabilization by grouting.

Soil exploration – Preliminary work – Site reconnaissance, trial pits, boring.

Types of soil samples – Procuring & handling of disturbed and undisturbed samples.

Presentation of soil investigation result.

### **10. CIVIL ENGINEERING DRAWING**

Isometric view, Development of surface.

## APPENDIX – “B”

### **SYLLABUS FOR WRITTEN TEST FOR RECRUITMENT TO THE POST OF JUNIOR ENGINEERS (MECHANICAL) IN WEST BENGAL SUBORDINATE SERVICE OF ENGINEERS**

#### **1. STRENGTH OF MATERIALS**

a) **Stress, Strain, Elasticity –**

Tensile, Compressive and Shear Stresses, Hooke's Law, Tensile test on M.S., Factor of Safety, Young's Modulus, Modulus of rigidity, Bulk Modulus, Poisson's Ratio, Temperature Stress, Hoop Stress, Longitudinal Stress, Strain energy. Ductility, Mobility & Plasticity.

b) **Riveted Joints –** Types of joints, failure of riveted joints, efficiency of joints, rivet joints in pressure vessel, structural joint.

c) **S.F. and B.M. –** Definition of beam, type of beam, types of loads, S.F. and B.M. diagrams for cantilever, simply supported and overhung beams with point loads and U.D.L., Point of Contraflexure.

d) **Bending Stress –** Assumptions in simple bending, Moment of resistance, Section modulus, Flitched beam, difference between neutral axis and neutral plane.

e) **Torsion of circular shafts (solid and hollow) –** Torque equation, power transmitted, Flange Couplings.

f) **Closed Coil helical spring –** Stress in spring, deflection, stiffness of springs, springs in series and parallel.

g) **Deflection of beam –** Cantilever, simply supported and overhung beams with point load and UDL, Superposition, Macaulay's Method.

h) **Columns and Struts –** Definition of Column and strut, types of columns, slenderness ratio, critical load, Euler's Formula, Rankine – Gordon's Formula (both ends fixed, one end fixed, other end hinged, both ends hinged, one end fixed, other end free – equivalent length).

#### **2. ENGINEERING MECHANICS**

a) **Centre of gravity and moment of Inertia –**

C.G. of regular areas and volumes, M.I. of regular areas, Perpendicular Axis Theorem, Parallel Axis Theorem, Mass M.I. of thin cylinder.

b) **Work, Power, Energy –** Definitions, Units, Conversion of Units, Kinetic energy, Potential energy, Power – M. K. S. and S. I. units.

c) **Transmission of Motion and Power –**

Belt drive – Velocity ratio, Simple and Compound drive, Initial Tension, Centrifugal Tension, Power transmitted, Speed for maximum power, Creep in Belt, belt length, Flat belt and V-belt drive – comparison.

Gear Drive – Types of gears, gear trains, types of gear trains, elements of spur gear, power transmitted.

d) **Lifting Machines –** Definitions, Mechanical advantage, velocity ratio, efficiency, condition for non-reversibility, velocity ratio for different types of lifting machines (simple and differential wheel and axle, differential pulley, screw jack, single purchase crab, worm and wheel).

e) **Friction –** Definitions, Laws of friction, angle of friction, angle of repose, limiting frictions, coefficient of friction.

#### **3. FLUID MECHANICS AND MACHINES**

a) Properties of fluid, units, measurement of pressure by manometers, Total pressure and centre of pressure of immersed flat surfaces, buoyancy and floatings, types of equilibrium of floating bodies.

b) Types of fluid flow, Types of energy, Continuity equation, Bernoulli's Theorem.

c) Measurement of fluid flow – Venturimeter, Orificemeter,  $C_d$ ,  $C_v$  and  $C_c$  of orifice, Notches (Rectangular and Vee), Pilot tube,

d) Losses in flow through pipes, Reynold's number – its significance.

e) Reciprocating Pumps – Types, Working Principle of a Reciprocating Pump, Pump Work, efficiency, Slip, Power, uses of Air Vessels, separation and cavitations, care and maintenance of reciprocating pumps.

f) Centrifugal Pump – Types, parts, pump heads, working principle, priming, selection of pumps, specific speed, work done, power, efficiency, performance, starting, care and maintenance.

g) Vert Turbine Pump.

h) Submersible Pump.

#### 4. HEAT POWER

- a) Units of pressure, Temperature, work, power, heat, first and second laws of thermodynamics, internal energy, enthalpy, entropy – unit of entropy.
- b) Difference between gas and vapour, characteristic equations of perfect gas, Universal gas constant, Specific heats at constant pressure and constant volume – their relationship, types of non-flow process for gases.
- c) I.C. Engines – Otto cycle and Diesel cycle – representation on P.V. and T-S diagram, thermal efficiency, comparison, Dual Combustion cycle – P-V and T-S diagram, use, parts of I.C. Engine.  
Working principle of petrol engine – 4-stroke and 2-stroke cycle engines, simple carburettor, preignition, Detonation, Supercharging, ignition systems.  
Working Principle of Diesel engine – 4-stroke and 2-stroke cycle engines, Air injection and solid injection, super charger & Torque convertor.  
Scavenging, valve timing, governing of I.C. Engines, Performance of I.C. Engine – indicator diagram, Indicated power, brake power, mechanical efficiency, thermal efficiencies, efficiency ratio, specific fuel consumption.  
Cooling systems of I.C. engines, components of cooling system.  
Care and maintenance – lubrication of I.C. engines.
- d) **Air Compressor –**  
Purpose of using compressors, field of application, classification, principle of working of reciprocating air compressor (single stage) and its performance, types of rotary compressors, comparison between reciprocating and rotary compressors, safety, care and maintenance.
- e) **Refrigerator and Air-conditioning –**  
Refrigerating effect, C.O.P., Properties of refrigerants, Refrigerants and pollution.  
Air Refrigeration – Reversed Carnof Cycle, Bell Coleman Cycle, uses.  
Vapour Compression Refrigeration – working principle, function of components, uses.  
Air-conditioning – Definition, types, factors of control.

#### 5. MANUFACTURING PROCESS

- a) **Heat treatment of Steel –**  
Carbon Steel and alloy steel, structural steel and tool steel. Iron carbon diagram (Phrases and temperatures of transformation), Hypo and hyperentectoid steel.  
Concept of heat treatment of steel and its purpose.  
Different heat treatment processes - Annealing, normalizing, hardening, tempering, case hardening process – Carburising, Nitriding, Cyaniding (Principle, Purpose and uses).  
Surface Hardening – Flame Hardening, Induction Hardening.  
Heat treatment of H.S.S. cutting tools (Principle & purposes).  
Heat treatment furnaces. Composition of different alloy.
- b) **Pattern Making –**  
Definition of pattern, pattern materials, selection of pattern material, advantages and limitations of wooden and metal patterns, pattern allowances, reasons for pattern allowances, factors controlling the allowances, types of pattern – fields of application.
- c) **Moulding –**  
Classification of moulding process, properties of moulding sand, preparation of moulding sand, moulding tools, Green sand moulding cope, drag, runner, riser, gatings, dry sand moulding, loam moulding, fit moulding, machine moulding.
- d) **Casting –**  
Melting of metals – furnaces required (Cupola, Tilting furnace).  
Casting process – sand casting, die casting, centrifugal casting, malleable casting, investment casting (process in brief and field of application).  
Fettling of casting, defects in castings, remedies, safety precautions in casting, testing of castings.
- e) **Welding and allied processes –**  
Definition of welding, classification, gas welding procedure, equipments, application, safety, types of flames – uses, function, use and types of fluxes.  
Arc welding – principle, equipments, application safety.  
Resistance welding – spot, butt, seam and projection.  
Welding – principle, equipments, uses.  
Thermit welding – principle of operations and applications.  
Special welding techniques – TIG, MIG, Electron Beam welding.  
Plasma Art welding, Electroslag welding, laser welding – principle and application.  
Defects in welding, remedies.  
Soldering, brazing – principle, application.

f) **Fitting –**

Various operations and corresponding tools used, measuring tools, marking tools, specifications, care and maintenance of tools.

g) **Mechanical working of metal –**

Forging – types (Hand, Power, Drop and press forging – Principles of operation), tools used, forging operations, characteristics, advantages and defects of forged parts.

Extrusion – definition, types, principles of operation, advantages, field of application.

Rolling – principles of hot and cold rolling, field of application, types of rolling mills – uses, spinning, wire drawing – principle of operation, field of application.

**6. MACHINE TOOLS**

a) Introduction – definition, classification, basic elements and purpose of machine tools, safety in machine shop, machine tool drives – classification.

b) Metal cutting – purpose and classification of cutting tools, cutting tool materials – comparative study, orthogonal and oblique cutting, tool life, tool wears, machinability, cutting fluids – properties, purposes and types.

c) Lathe and Lathe work

Types, classification of Lathe Centre Lathe specification, parts, accessories, attachments, feed mechanism, feed reversing mechanism, operations – turning, facing, taper turning, thread cutting, boring, knurling etc. different types of lathe tools, tools elements, tool signature, cutting speed, feed, depth of cut.

d) Drilling Machine

Classification and specification of various types drilling machines, construction, uses and limitations of different types of drilling machines, different types of drills – specifications, nomenclature of twist drills, tap drill size, different operations in drilling machines, work holding devices, tool holding devices.

e) Shaper and Planer

Classification and specification of shaper, parts of shaper – their functions, work holding devices, driving mechanism, quick return mechanism, stroke length adjustment, stroke position adjustment, feed mechanism, shaper operations, clapper box.

Classification and specification of planer, different parts of planer, driving mechanism, quick return mechanism, operation, comparison of shaper and planer.

f) Milling Machine

Classification, specification of milling machines names and functions of different parts of plain, vertical and universal milling machines, attachments, milling process, milling operations, milling cutter – classification, negative rake milling, safety, care and maintenance of milling machine.

g) Gear Cutting

Gear cutting by formed milling cutter, indexing simple and differential, angular indexing.

Rack cutter, pinion cutter, gear hob – working principle, job tool movement.

h) Grinding and Grinders

Grinding wheel – composition, abrasives – types, properties, uses, bonds – types and uses, Grit, grade and structure of wheels, factors in selecting grinding wheel, mounting of wheels, glazing and loading, dressing, tramping and balancing of grinding wheels, care and maintenance of grinding wheels, external, internal and surface grinding, centreless grinding, honing and lapping.

i) Jigs and Fixtures

Definition, comparison, purpose, location, clamping, guide bushes.

j) Non-traditional machining

Classification, advantages of non-traditional machining, EDM, ECM, USM, LBM – working principle, advantages, limitation, field of application.

k) Numerical Control Machine Tools

Meaning of NC and CNC, advantages of CNC, various components of NC and CNC machine tools and their functions.

l) Different types of thread & their use.

Maintenance of machinery & equipments. Limits & Fits. Air & Water pollution and control.

## APPENDIX – “C”

### SYLLABUS FOR WRITTEN TEST FOR RECRUITMENT TO THE POST OF JUNIOR ENGINEERS (ELECTRICAL) IN WEST BENGAL SUBORDINATE SERVICE OF ENGINEERS

**Materials :** Conducting, Magnetic, Insulating, Contact, fuse materials, semi conductor.

#### **ELEMENTARY CIRCUIT ANALYSIS :**

**D.C. Circuit :** Star-delta conversion, Thevenin's theorem, Norton's theorem, Superposition theorem.

**A.C. Circuit :** Single Phase R, L & C Series, Parallel : resonance.

**Three Phase :** Star & delta connection, three phase 4 wire, neutral current measurement.

**Measuring Instruments :** D.C. & A.C. Ammeter & Voltmeter; A.C. Wattmeters, Energy meters, Frequency meters, Reactive power measurement, maximum demand indicator; testing & errors of energy meters, Megar Insulation Tester, Earth Megar Tester.

**Power Factor :** Effects of low power factor; methods of improving power factor.

**Motors :** Type of D.C. Motors – Speed Control; Induction motors; Different types of starters D.C. & A.C.; Applications of different motors – D.C. & A.C. (single phase, three phase); Selection of motors for various types of load.

**Transformers :** Single phase, Three phase connection, methods of cooling, oil testing, properties, Auto-transformers, Parallel operation.

**O.H. Line :** Conductors : Types of poles, stays & struts, type of insulators and their applications; Feeders, distributors, service mains, radial & ring main feeder; primary & Secondary distribution of single phase and poly phase system; line sag on level ground.

**Cable :** P.I.L.C. & P.V.C. cable, methods of cable laying; cable rating & devating factor.

**Protective Devices :** Fuses – fuse elements, types; current limiting reactors; Thermal, electromagnetic, Induction type relays; Types of Circuit breakers to principle of operation, Isolators.

**Earthing :** Domestic installation & motors; pole earthing, Earth resistance measurement; Horn gap & thyrite type lightning arrestor.

**Design, Estimating :** Design of lighting Scheme in a hall, class room, workshop, electrical installation of machines in a small workshop, estimation of house service connection; design of small transformers upto 100 VA; Rate analysis factor governing it – specification & schedule of work.

**Battery :** Types of storage battery, different elements, charging methods, maintenance.

**Generation :** Various conventional & non-conventional sources of energy. Different tariff systems and bill calculation.

**Electronics :** Different types of transistors – their biasing & action; Amplifier – single stage transistor, multistage. Definition of gain, frequency response, bandwidth. Voltage & power amplifier difference; transformer coupled Class-B push-pull amplifier – advantages & disadvantages, uses, Feed back in amplifier.

**Oscillator :** Types; functions of filter circuits; different rectifier circuit. Indian Electricity Rules. Extra high voltage, High voltage Switchgears protections. Pumps, lifts, Air-conditioning–Basic principle of operation safety & control.

**Conservation of Energy –** G.L.S. Lamp – Energy Efficient Lamp. Illumination – Level of Illumination & Measuring.

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